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Remarks

Claims 1-20 and 23-39 are pending. Claim 1 has been amended to specify that the intensity of the UV radiation in (c) is between about 2230 and 3118 W/cm² and the exposure to UV radiation occurs for a time period between about 1 and 200 seconds. These amendments are supported by page 14, lines 3-21 and FIG. 2B. Claims 21 and 22 have been canceled.

The Rejections

All claims have been rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of US Published Application No. US 2004/0096672 to Lukas et al. ("Lukas") in view of U.S. Patent No. 6,444,715 to Murkherjee et al. ("Murkherjee").

Claims 1-20 and 23-29

Claim 1 has been amended to specify that the UV radiation in (c) is between about 2230 and 3118 W/cm² and the exposure to UV radiation occurs for a time period between about 1 and 200 seconds. Applicants have claimed an optimum range of powers and corresponding exposure times that result in an increase in hardness without an unacceptably high increase in k-value.

Hardness values and k-values increase with increased UV exposure time. For many applications, acceptable k values range between about 2 and 2.9, e.g., between about 2.2 and 2.7 (see page 13, lines 1-5). FIG. 2B shows that for the relatively high intensity of 3118 W/cm², the k for a wafer exposed to radiation of 200 seconds (data point 209) is about 2.7. This is discussed in the specification at page 14, lines 12-14. Longer exposure times, however, may result in k-values above 2.9, as shown in the figure.

Hardness and k-value curves for 2230 W/cm² show that between about 0 and 200 seconds the hardness increases at a faster rate than the k-value (see FIG. 2B, wherein the slope of the 2230 W/cm² hardness curve is much steeper than the corresponding k-value curve below about 200 seconds). After about 200 seconds, the increase in hardness slows in relation to exposure time and comes at a cost of an increase in k-value at about the same rate.

Thus, Applicants' claimed intensity and exposure time ranges result in an increase in hardness without an unacceptably high or fast increase in dielectric constant.

Applicants submit that neither of the references teach or suggest the claimed optimal range of exposure times and power densities with sufficient specificity to anticipate the claimed invention. Nor are these ranges suggested by the references, either alone or in combination.

Murkhejee mentions ultraviolet radiation as a catalyst for a photocatalyzed method of curing a dielectric material (col. 11, 44-48). There is no teaching of the claimed ranges, nor of the advantages of using the claimed ranges.

Lukas also mentions a photocuring process using IR, visible, UV or deep UV, a power of 0 to 5000 W and a curing time of 0.01 min to 12 hours (paragraph 0064). There is no teaching of the claimed ranges, nor of the advantages of using the claimed ranges. Applicants note for example that Lukas' exposure time range is from 0.6 to 43200 seconds – the upper end of which is 216 times that of Applicants' claims, while Murkhejee is silent on exposure times. There is no teaching or suggestion in either reference of the unexpected benefits derived from Applicants' claimed optimum ranges.

For at least these reasons, Applicants' submit that claim 1, and its dependent claims, are patentable over the cited art.

Claims 30-39

Claim 30 recites the operation of “(d) activating a gas by exposure to ultraviolet radiation ... to produce a species that cleans porogen residue from surfaces within the reaction chamber.” As discussed in the specification, porogen residues can be particularly problematic if they coat the window through which the UV radiation passes.

Neither Lukas nor Murkeejee teach or suggest (d) activating a gas by exposure to ultraviolet radiation of a third wavelength distribution to produce a species that cleans porogen residue from surfaces within the reaction chamber. At least for this reason, Applicants submit that claim 30, and the claims that depend from it, are patentable over the cited references.

For at least these reasons, Applicants request that the Examiner withdraw these 35 U.S.C. § 103(a) rejections.

Conclusion

Applicants believe that all pending claims are allowable and respectfully request a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a

telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

Respectfully submitted,
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